ATOMIC MODELS AND COMPONENTS OF THE ATOM

Unit Introduction

In this unit you will learn all about the atom. First, explore the history of atomic models and contributions of various scientists. Then, learn about the components of atoms.

Models of the Atom

In science, the smallest particle that can exist and still have the properties of the element is called an ***atom***. Science has developed many models throughout our scientific history to describe or illustrate the makeup of an atom. Over time, technology has allowed scientists to discover more details about the structure of atoms.

The following website is very helpful in understanding the timeline of various atomic models of the past and present:

https://www.texasgateway.org/sites/default/files/resources/documents/EvolutionOfAtomicModel.pdf

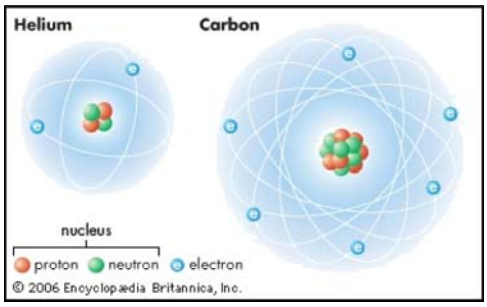
Use this table to take notes and summarize the history of atomic models:

SUDENT COPY OF ATOM DOCUMENT

Scientist	Time	Background	Summary	Image of Model
Democritus	470-380 BC	Greek philosopher; known as the father of modern atomic thought	matter is made of small particles called "atomos" that cannot be broken down any further	
Dalton				
Thomson				
Rutherford				
Bohr				
Chadwick				
Modern				

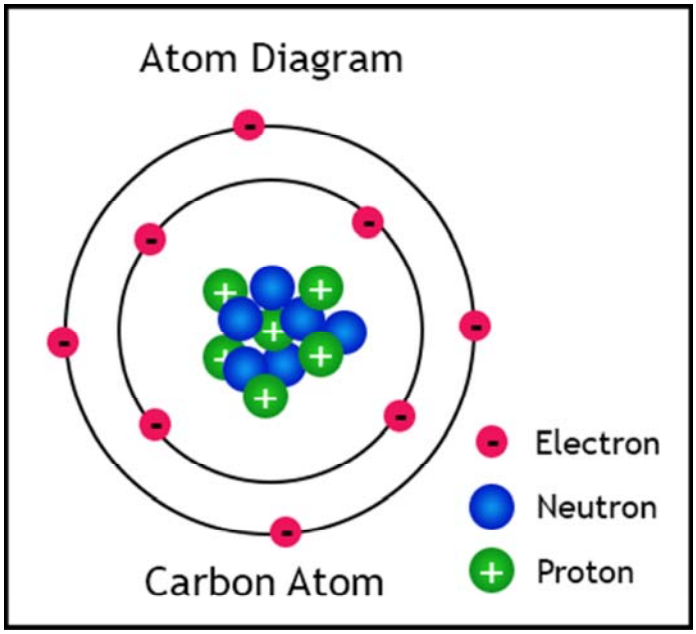
The currently popular atomic model is called the electron cloud model. In the case of the atom, models are being used to describe or illustrate something that is too small to see. We cannot see an atom and its components with the naked eye, so a model allows us to conceptually grasp what an atom looks like.

Atomic models of helium and carbon:



Atomic Components

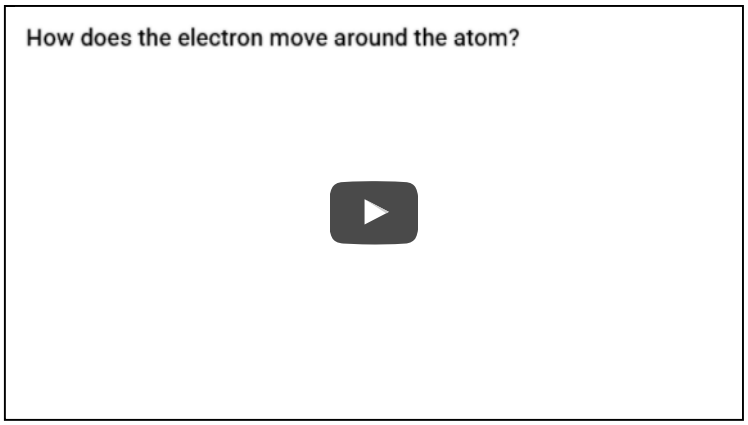
Atoms are very tiny particles that consist mostly of empty space. Atoms are made of even smaller components, known collectively as subatomic particles. There are three main subatomic particles, known as protons, electrons, and neutrons. ***Protons*** have a positive charge and they are found in the nucleus. ***Neutrons*** have a neutral charge and they are also found in the nucleus. Since the nucleus has particles of neutral and positive charges, the overall charge of the nucleus is positive. Atoms are electrically neutral overall, which means that there needs to be an area of negativity to balance out the positive nucleus. That negativity is found in electrons. ***Electrons*** have a negative charge and they orbit around the outside of the nucleus.



Watch the following video clip to learn more about the atom and its components:

QuickTime The Atom (4:18)

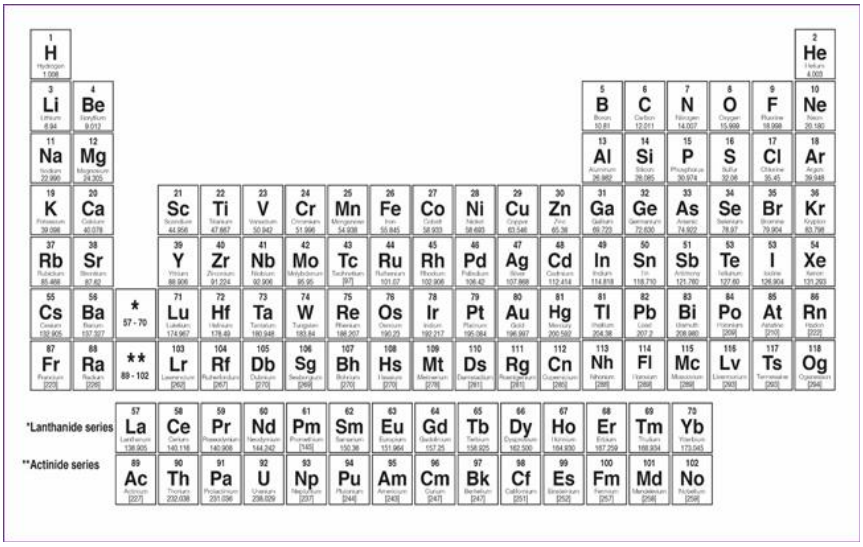
This video clip shows an interesting perspective on how electrons move about inside the atom:



Atomic Mass

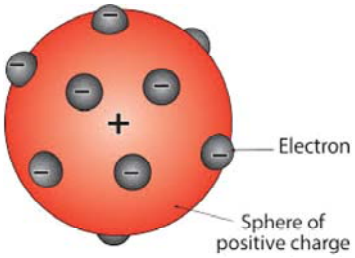
Protons and neutrons contribute to the mass of the atom, but the mass of electrons is negligible since they are so tiny. One proton has a mass of one atomic mass unit, or 1 AMU. One neutron also has a mass of 1 AMU. The mass of electrons is not considered when calculating the total mass of the atom.

What makes an atom of one element different from an atom of another element is the number of protons in its nucleus, or its ***atomic number***. The number of protons plus the number of neutrons in its nucleus is known as its ***atomic mass***. When you look at the periodic table, such as the one below, the atomic number is at the top and the atomic mass is indicated for each element at the bottom of the square.

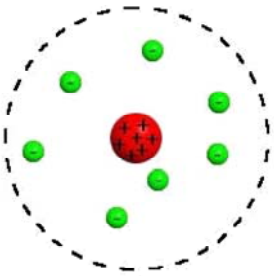


Rutherford's Experiment

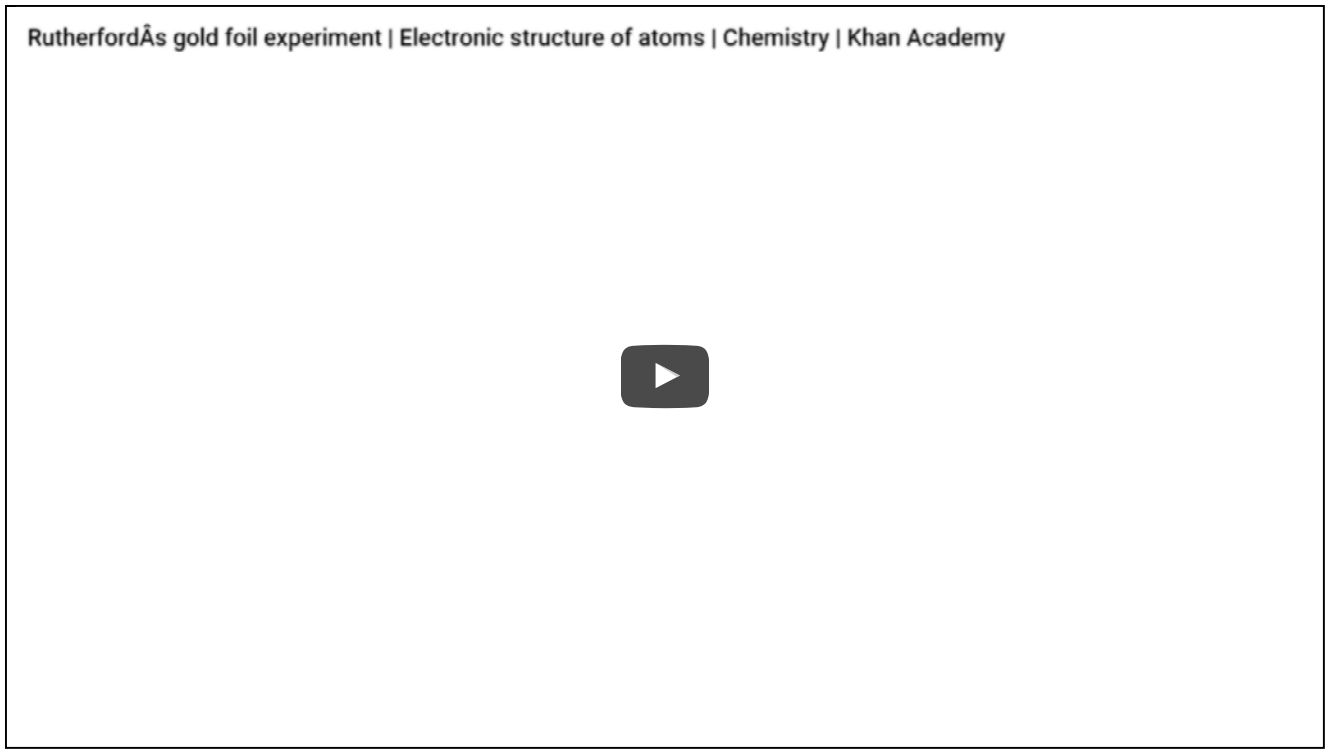
What we know about the structure of the atom and the charged particles is due in large part to Ernest Rutherford's gold foil experiment. Previously to his studies, the widely accepted atomic model was Thomson's raisin bun model, which hypothesized a positively charged solid atom with negatively charged particles dispersed throughout the atom. The raisin bun model Thomson developed looked like this:



Rutherford wanted to expand knowledge of the atom, so he proposed that blasting alpha particles through a thin sheet of gold foil would cause the particles to penetrate the foil or possibly be deflected off to the side. What he found is that every once in a while, particles bounced back. This led to his discovery of a tiny, but massive, positively charged nucleus in the center of the atom, as well as negatively charged electrons that circle the nucleus in empty space surrounding the nucleus. His nuclear model of the atom looked like this:

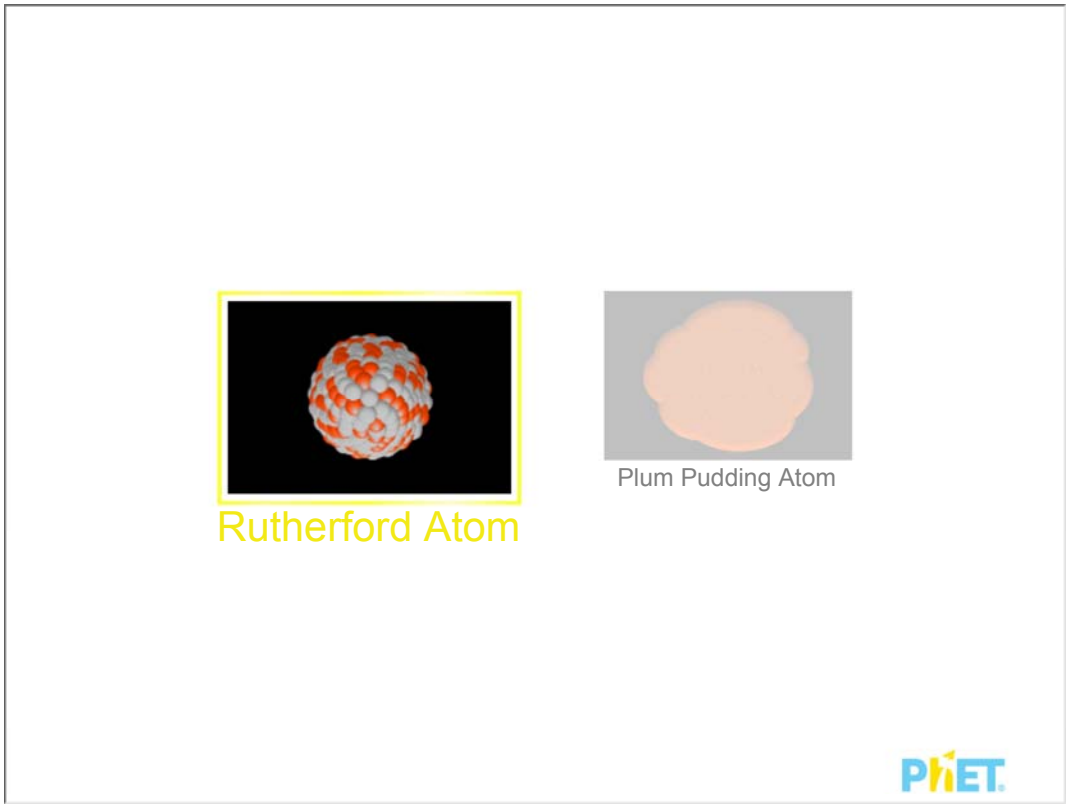


The following video clip will help to expand your knowledge and understanding of Rutherford's gold foil experiment. As you watch, create an annotated diagram that shows the experiment with the information that Rutherford discovered by completing the experiment. Scan or photograph your diagram and submit your work for question #13 in the assessment portion of the unit.



PhET Simulation: Rutherford Scattering

Now, imagine that you are conducting Rutherford's gold foil experiment. Go to the following website to interact with the simulation. Complete the attached document and submit your work for question #14 in the assessment portion of the unit.



STUDENT PHET SIMULATION DOCUMENT

Quizlet Vocabulary

https://quizlet.com/_3b27sl

Now answer questions 1 through 14.